About radioactive waste disposal facility Buryakovka

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Abstract – For over forty years now, many countries have been developing near surface facilities for the disposal of low and intermediate radioactive waste (LILW) generated within the nuclear fuel cycle and from the use of radioactive sources for different purposes. In line with the internationally agreed principles of radioactive waste management and the related safety standards, the safety of these facilities needs to be ensured during all stages of their lifetime, including the post-closure period. Today Buryakovka is still being operated but its capacity of approximately 690,000 m^3 is nearly reached: Extrapolating the current disposal rate the remaining capacity might be exhausted before the end of 2013.

Key words – radioactive waste, Exclusion Zone, radioactive waste disposal facility, Buryakovka,safety assessment.

I. Introduction

The RWDF Buryakovka was planned and constructed during the acute phase of the radiation accident at ChNPP(Chernobyl nuclear power plan) in 1986 as part of the intervention measures taken to mitigate the accident consequences. The surface repository is a trench-type facility for solid – mostly bulk – waste originating from decontamination activities in the Exclusion Zone (EZ). Today, the RWDF(radioactive waste disposal facility) Buryakovka is still being operated but its capacity of approximately 690,000 m^3 is nearly reached: Extrapolating the current disposal rate the remaining capacity might be exhausted before the end of 2013. Plans for reconstruction and enlargement of the facility were developed more than 10 years ago, but mainly for financial reasons they have not been technically implemented yet. The disposal of radioactive waste needs to be carried out in a manner that provides an acceptable level of safety and which can be demonstrated to comply with the established regulatory requirements and criteria. Safety assessment techniques are used to evaluate the performance of a waste disposal facility and its impact on human health and the environment.

II. About safety assessment

For over forty years now, many countries have been developing near surface facilities for the disposal of low and intermediate radioactive waste (LILW) generated within the nuclear fuel cycle and from the use of radioactive sources for different purposes. In line with the internationally agreed principles of radioactive waste management and the related safety standards, the safety of these facilities needs to be ensured during all stages of their lifetime, including the post-closure period. Formal methodologies for evaluating the long term safety of such facilities have been developed over the years, but intercomparisons of these methodologies carried out by the IAEA [1] have revealed a number of discrepancies between them.

The ISAM project involved the review and enhancement of post-closure safety assessment methodologies and tools for both existing and proposed near surface radioactive waste disposal facilities.

In order to help achieve these objectives, the ISAM project paid particular attention to discussing, agreeing and setting down a safety assessment methodology.

The ISAM project primarily focused on developing a consensus on the methodological aspects of safety assessment, but also gave considerable attention to illustrating the application of the methodology to three main types of disposal facilities (vault, RADON and borehole type disposal facilities).

Taking into consideration the more recent approaches to safety assessment for near surface disposal facilities, the ISAM project identified the need to address the following key components:

- Specification of the assessment context;
- Description of the waste disposal system;
- Development and justification of scenarios;
- Formulation and implementation of models;
- Analysis of results and building of confidence.

Post-closure safety assessment of a radioactive waste disposal facility is generally undertaken to provide confidence to government, regulatory authorities, the general public and technical/scientific personnel that the facility has been/will be sited and engineered to ensure the safety of people and protection of the environment over long timescales. However, this generic objective does not provide a very precise description of what has to be considered in the assessment. The assessment context is intended to provide the next level of description and should answer the two questions:

- What is being assessed? and
- Why is it being assessed?

In a quantitative assessment, these questions become:

- What is being calculated? and
- Why is it being calculated?

Historically, the questions have not been answered very clearly. The answers to the two questions were for the waste form and package: radionuclide release from the near field; and to provide input for geosphere assessment.

For the geosphere assessment, the answers were formulated as follows: radionuclide release from the geosphere; and to provide input for the biosphere assessment [2],[3].

For the biosphere component of the assessment, the answers were not so simple. Concerning what is to be calculated, there was generally no agreement on what type of dose or risk to calculate: dose to whom? risk of what? Concerning why, sometimes the intentions would be to make assessment of the dose, in other cases the intention would be to demonstrate that a dose level would not be exceeded. Without guidance, the person undertaking the biosphere assessment could be left to make their own decisions. Sensible approaches were taken in isolation, but the result could be inconsistent, both within the individual total system assessments, and when different assessments were compared.

The assessment context provides a framework for performance of the safety assessment, and it covers the following key aspects: purpose; regulatory framework; assessment end-points; assessment philosophy; disposal system characteristics; and timeframes.

III. Repository site and characteristics

RWDF Buryakovka is the only operating repository for radioactive waste in the Chernobyl Exclusion Zone. In its current state, RWDF Buryakovka comprises 30 near-surface trenches used for disposal of solid LILW. By the end of 2012, 29 of these trenches were filled and the remaining capacity will be exhausted in the near future. Accordingly, plans have been made to reconstruct and enlarge the repository. Located 12 km south-west of the Chernobyl NPP in the southwestern sector of the 2600 km² zone of special radiation hazard, established within the larger Exclusion Zone to monitor the radioactively most contaminated areas around the "Shelter" facility and ChNPP. The upper geological layers at the site are Quaternary and Tertiary sediments. The upper 70 m consist of Quaternary fluvio-glacial sands interbedded with sandy loam and clay loam. The Quaternary sequence is separated from the subjacent Eocene sands of the Buchaksk-Kanev Eocene formation by marly clays of the Eocene Kiev formation with an average thickness of 12 m.

Within the explored depth at the RWDF Buryakovka site, there are two aquifer systems, one inside the Quaternary sediments and one inside the Eocene sediments separated by the Kiev formation. Within the Quaternary aquifer system, water bearing sands of different grain size are interbedded with clay/loam layers including moraine layers, however, the insular distribution of these layers practically does not lead to a separation of the Quaternary aquifer complex into unconnected horizons. In the area of RWDF Buryakovka groundwater levels (GWL) are recorded at depths ranging from 12.2 to 19.2 m below ground level (123.1 – 124.2 m above sea level). The groundwater flow in this aquifer is supposed to be directed to the southeast. It has to be noted, however, that the site is located in the area of an underground watershed and the groundwater situation is rather complicated.

RWDF Buryakovka accepts for disposal solid LILW that is generated as a result of decontamination work within the Exclusion Zone, at ChNPP, and at the "Shelter" object.

According to initial design the existing trenches have horizontal dimensions of 58.8 by 150 m at the surface and a maximum depth of 5.6 m. The flat bottom area of the trench measures 16 by 100 m and the internal side walls are constructed with a slope of 1:4. The trenches are arranged in three rows of 10 trenches within the 1200 by 700 m repository area.

Construction of the trenches has been carried out according to the following sequence. First step after the excavation of the trenches is the emplacement of a 1.0 m layer of compacted clay on the bottom and side walls of each trench. Design properties of this layer are a density of 1600-1.650 kg/m and a filtration coefficient kf of ≤ 2 10-3 m/day. On top of the clay layer, a sand layer of 0.6 m thickness is placed to protect the integrity of the clay layer underneath. Disposal is usually carried out by unloading bulk waste into the trenches followed by distribution and compacting of the waste using bulldozers.

Average capacity per trench is 23 thousand m3 of compacted waste, but individual capacities may differ significantly depending on the technical realization of the design dimensions during construction of individual trenches. After complete filling of the trenches, a 0.6 m levelling layer of local soil, a clay screen of 0.5 m thickness with same properties as the base clay layer, and a 1.0 m layer of soil, on which grass is being cultivated, are placed on top of the radioactive waste. The radioactive waste pile is up to 6 m high.

According to initial design the roof should have been inclined to the sides with a slope of 1/10[4].

Conclusion

In this paper was reviewed RWDF Buryakovka location, geological structure fields and aquifers. All that is necessary for further safety assessment. Very necessary to carry out a safety assessment in relation to the complete filling of the repository and its reorganization.

Safety assessment methodology described in this article is the most recent, and in my opinion is coordinated with our legal documents. The structure of the tranches of waste is important for generating models, with which there is a safety assessment.

References

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